WHAT IS CLAIMED IS:

1. A method of tracking vocal tract resonance frequency in a speech signal, the method comprising:

defining a state equation that is linear with respect to a past vocal tract resonance vector and that predicts a current vocal tract resonance vector;

defining an observation equation that is linear with respect to a current vocal tract resonance vector and that predicts at least one component of an observation vector; and

using the state equation, the observation equation, and a sequence of observation vectors to identify a sequence of vocal tract resonance vectors, each vocal tract resonance vector comprising at least one vocal tract resonance frequency.

2. The method of claim 1 wherein using the state equation, the observation equation, and the sequence of observation vectors to identify a sequence of vocal tract resonance vectors comprises applying the state equation, the observation equation and the sequence of observation vectors to a Kalman Filter.

3. The method of claim 1 wherein identifying a vocal tract resonance vector comprises identifying a

vocal tract resonance vector from a continuous set of values.

4. The method of claim 1 wherein defining the observation equation comprises defining a linear approximation to a function that is non-linear with respect to the vocal tract resonance vector.

5. The method of claim 4 wherein defining the observation equation further comprises defining a linear approximation to the product of two functions that are each non-linear with respect to the vocal tract resonance vector.

6. The method of claim 5 wherein one of the functions that is non-linear with respect to the vocal tract resonance vector is an exponential function that is non-linear with respect to the bandwidth components of the vocal tract resonance vector.

7. The method of claim 5 wherein one of the functions that is non-linear with respect to the vocal tract resonance vector is a sinusoidal function that is non-linear with respect to the frequency components of the vocal tract resonance vector.

8. The method of claim 4 wherein defining a linear approximation comprises selecting a linear approximation from a set of linear approximations

that together form a piecewise linear approximation to the non-linear function.

9. The method of claim 4 wherein defining a linear approximation comprises evaluating the non-linear function based on an estimate of a vocal tract resonance vector to produce a non-linear function value and using the non-linear function value to select parameters for the linear approximation.

10. The method of claim 9 wherein defining a linear approximation further comprises using the non-linear function value to select a linear approximation from a set of linear approximations that together form a piecewise linear approximation to the non-linear function.

11. The method of claim 1 further comprising:

using the identified vocal tract resonance vectors to redefine the observation equation; and

using the redefined observation equation, the state equation, and the observation vectors to identify a new sequence of vocal tract resonance vectors.

12. The method of claim 11 wherein redefining the observation equation comprises using an identified vocal tract resonance vector to select

parameters for at least one linear approximation to a function that is non-linear with respect to a vocal tract resonance vector.

13. The method of claim 12 wherein using an identified vocal tract resonance vector to select parameters comprises evaluating the non-linear function using the vocal tract resonance vector to produce a non-linear function value and using the non-linear function value to select parameters for at least one linear approximation.

14. A computer-readable medium having computer-executable instructions for performing steps comprising:

using an estimate of at least one vocal tract resonance component to select a linear approximation to a function that is non-linear with respect to the vocal tract resonance component;

using the linear approximation to define an observation equation; and

using the observation equation and at least one observed vector to re-estimate the vocal tract resonance component.

15. The computer-readable medium of claim 14 wherein selecting a linear approximation comprises selecting one linear approximation from a set of

linear approximations that form a piecewise linear approximation of the non-linear function.

16. The computer-readable medium of claim 14 wherein selecting a linear approximation comprises applying the vocal tract resonance component to the non-linear function to form a function value and selecting the linear approximation based on the function value.

17. The computer-readable medium of claim 14 wherein re-estimating the value of the vocal tract resonance component further comprises using a state equation that is linear with respect to the vocal tract resonance component.

18. The computer-readable medium of claim 17 wherein re-estimating the value of the vocal tract resonance component further comprises applying the state equation, the observation equation and the at least one observed vector to a Kalman Filter.

19. The computer-readable medium of claim 14 further comprising selecting a second linear approximation to a second function that is non-linear with respect to the vocal tract resonance component and using the second linear approximation to define the observation equation.

20. The computer-readable medium of claim 14 wherein the non-linear function comprises an exponential function.

21. The computer-readable medium of claim 14 wherein the non-linear function comprises a sinusoidal function.

22. The computer-readable medium of claim 14 wherein the vocal tract resonance component is continuous valued.